The MIPP RICH detector plan of action

Rajendran Raja
30-March-04

The "smoke related event" of March 14, 2004 in MIPP has now been shown to be a fire in the photomultiplier (pmt) box. It was very likely due to a "short" in the HV power in the PMT box. The defense systems that the RICH had were all designed to guard against temperature rise in the pmt box which would have killed the HV supply by three temperature switches (klixons, that were supposed to turn off the HV at 50°C). Two of the three klixons survived and were later tested to work correctly. The third one was in the center of the fire and was charred to a crisp. The moment there was ignition in the pmt box, then the energy source of the heat was transferred from the HV outside the box to the insulation and other combustibles within the box. At this point, the klixons became irrelevant and turning of the HV by the interlock was of no use. The interlock, incidentally was found to be in a tripped state after the fire.

The fire has destroyed about 1/3 of the detector. We must test the remaining phototubes to see if the rest are functional. If so, it should be possible to redeploy a RICH with somewhat sparse a pmt array that would still do good physics. I call this Phase 1 of the recovery plan. It is likely that there exist good tubes which need new bases. Building bases and/or buying additional tubes and bases (if needed) is termed phase II and will require extra funds (beyond what is earmarked for MIPP this year). In order to redeploy a phase I detector, we need to employ new safety safeguards to ensure that we will never be victim to an incident such as this again.

What follows is due to the input of many people, too many to name individually. Members of the RICH panel have helped considerably in arriving at this suggested course of action.

Phase I tasks

0)Remove the good pmt's from the pmt box and put them in labeled plastic boxes. Move the pmt box to Lab xx.

1)pmt testing- The pmt's on the right of the fire have been removed. There exist several columns of pmt's that are too fused together to remove individually. The bases are destroyed. The pmt's may or may not work. The pmt's to the left of this region are still in the pmt box.

While it is possible to test these pmt's in situ by locking up the box and turning on the HV, it was decided not to follow this risky course, since if a fire broke out, we will have to open the box (10 –15 mins) to put it out. Measurements made by Jim Priest today on the flammability of pmt bases (he was able to set fire to a Russian base by sparking it by a piezoelectric system) reinforce the conclusion that it is too risky to turn on the HV in situ till we have better safeguards. The coolers need to be repaired for this also.

In order to test the pmt's, we will employ the Selex pmt testing system whereby 16 pmt's can be tested simultaneously to see if they work in ~ 20 mins. So to test all the pmt's is less than ~ 70 hours of testing. This stand however needs the following upgrades

a)LED light has to be fed in to the 16 pmt's individually using optical clear fibers.
b)An interlock needs to be put in so that opening the box will kill the HV.
c)The MIPP readout card should be used to read out the pmt's.
d) A database of pmt's tested needs to be built.

Only after we build confidence testing a large number of pmt's can we be sure that our phase 1 plan is sufficient.

2)Cooler + blower refurbishment.
We need to clean out the gunk in the cooler system and hook it up correctly. This task is under way and should be completed by the end of this week, I am told.

3)Temperature Monitoring and Mixer fan hook up

The 4 temperature monitors need to be hooked into APACS. This task is complete. We may want to kill the HV if the temperature is off limits as a second level defense. The mixer fans were never hooked up, due to a lack of a good connector. I am told that this has been remedied.

4)Recover the pmt's

Recover the pmt's that are stuck together. This can be done in Lab xx after the box has moved.

5)Install safeguards against fire

Several safeguards have been proposed against a fire from occurring again. We list them here. The panel should come up with a final set of measures.

a)Install a smoke detector in the pmt box and connect it to a halon system.
b)Inert the pmt box using nitrogen
c)Glyptol all the bases so that sparks do not occur. We should investigate the tube in column 89 that sparks readily to see why sparks occur.
d)fuse the individual HV cables (2848 of them in a full RICH) so that we cannot power a short to cause a fire. A sub-measure here would be fuse all the set of 16 plet tubes. There are 178 of these.

6)Pass Safety and re-install the detector

I would like to see an aggressive plan to get the above tasks accomplished in ~ 4 weeks. This would require technician help (we have been promised that by Fermilab) and the

presence of all the responsible parties at Fermilab on a continuous basis during this period.

Phase II tasks

After the tube testing is complete, we will have to decide if phase II is needed. If so, we will have to embark on the design of new bases. We do not have the time to redesign all the bases, but only to build new ones similar in design to the existing ones(but safer). Also, we may need to acquire new pmt's. I am told that ~ 115 new Russian pmt's are available from Protvino at $45 each and ~ 900 used pmt's (and tested to be inferior to the ones we have) are available for ~ $15 each. We may, depending on the availability of funds, decide to buy Hamamatsu tubes. The University groups in charge of the RICH are encouraged to solicit funds from the funding agencies to cover this eventuality.

More columns can be installed as needed (as we complete them) if we are forced to this route.